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IODP Expedition 327: Juan de Fuca Ridge-Flank Hydrogeology

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Integrated Ocean Drilling Program (IODP) Expedition 327 focus on understanding fluid-rock interactions in young, upper ocean crust on the eastern flank of the Juan de Fuca Ridge, delineating the magnitude and distribution of hydrologic properties; the extent to which crustal compartments are connected or isolated; the rates and spatial extent of ridge-flank fluid circulation; and links between ridge-flank circulation, crustal alteration, and geomicrobial processes. Expedition 327 installed seafloor borehole observatories (CORKs) in basement holes to allow borehole conditions to recover to a more natural state after the dissipation of disturbances caused by drilling, casing, and other operations; provide a long-term monitoring and sampling presence for determining fluid pressure, temperature, composition, and microbiology; and facilitate the completion of active experiments to resolve crustal hydrogeologic conditions and processes.

During Expedition 327, two basement holes were cored and drilled at Site U1362. Hole U1362A was cored and drilled to 528 meters below seafloor (mbsf) (292 meters subbasement [msb]), subjected to geophysical logging and hydrologic testing, and instrumented with a multilevel CORK observatory. Hole U1362B was drilled to 359 mbsf (117 msb), subjected to a 24 h pumping and tracer injection experiment, and instrumented with a single-level CORK observatory. Both CORK observatories include monitoring of pressure and temperature and downhole fluid and microbiology sampling. In addition, part of an instrument string deployed in Hole U1301B during Expedition 301 was recovered, and a replacement string of thermal sensors was installed. Finally, a program of shallow sediment coring was completed adjacent to Grizzly Bare outcrop, a suspected site of regional hydrothermal recharge. Thermal measurements and analyses of pore fluid and microbiological samples from a series of holes aligned radially from the outcrop edge will elucidate rates of fluid transport and evolution during the initial stages of ridge-flank hydrothermal circulation.

Keywords: IODP, Hydrogeology, Anisotropy, Crustal-scale properties, Microbiology